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Research Article

Modeling Alphabet Skills as Instructive Feedback Within a Phonological Awareness Intervention

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Purpose: This study evaluated the efficacy of an instructive feedback strategy for modeling letter names and sounds during presentation of positive feedback within a small-group phonological awareness intervention for preschoolers.
Method: Two experiments were conducted using multiple-baseline designs across children and behaviors. Letter name and sound identification and performance on a phonological awareness fluency measure served as the primary outcome variables. Six children completed Experiment 1. A progressive time delay was added to instructive feedback to elicit a response from the 9 children in the second experiment.
Results: In the first experiment, 6 children demonstrated gains on phonological awareness but not alphabet knowledge. With the addition of progressive time delay in the second experiment, all 9 children demonstrated gains on letter name and sound identification as well as phonological awareness skills.
Conclusions: Progressive time delay to prompt children's responses appears to bolster the effects of instructive feedback as an efficient strategy for modeling alphabet skills within a broader early literacy curriculum. Modeling alphabet skills did not detract from, and may have enhanced, phonological awareness instruction for preschoolers.

Multiple skills are associated with early reading ability, including phonological awareness (PA) and alphabet knowledge, and these emergent literacy skills form the foundation for conventional reading (National Early Literacy Panel, 2008). There are indications that high-quality curricula that teach these skills may prevent later reading difficulties (Torgesen, 2002). Unfortunately, many preschool children are not exposed to these foundational skills (Justice, Mashburne, Hamre, & Pianta, 2008). For children demonstrating deficits in these skills, instruction should be more supportive, explicit, comprehensive, and intensive than instruction in the general curriculum (Foorman & Torgesen, 2001). However, barriers to implementing tiered supports for emergent literacy in preschool classrooms include a lack of evidence-based interventions for teaching foundational literacy skills within a tiered framework (Greenwood et al., 2011). Thus, the pupose of this study is to determine the efficacy of an instructional method, instructive feedback, for integrating PA and alphabet instruction within an early literacy intervention for preschoolers.

PA is defined as sensitivity to the sound structure of oral language (Anthony & Francis, 2005). PA is correlated with reading outcomes, even when controlling for general cognitive ability (Anthony, Williams, McDonald, & Francis, 2007). Interventions often result in large effect sizes for PA (.86) and moderate effect sizes for reading (.53) and spelling (.59; Ehri et al., 2001). PA typically develops around the preschool years and is predictive of later reading outcomes (Storch & Whitehurst, 2002). Explicit instruction with multiple opportunities to respond and practice PA may be necessary for its development (Phillips, Clancy-Manchetti, & Lonigan, 2008).

Alphabet knowledge refers to the ability to identify, name, and write letters and produce the sounds corresponding to letters (Piasta & Wagner, 2010). Knowledge of letter names and their corresponding sounds is perhaps the best predictor of later reading ability (Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004). Johnston, Anderson, and Holligan (1996) found that alphabet knowledge

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accounted for significant variance in preschoolers' phoneme awareness and name-reading ability. In a longitudinal study, PA and alphabet knowledge accounted for more than half the variance in first-grade reading ability (Lonigan, Burgess, & Anthony, 2000). Attention to individual letters may help children associate letters with speech sounds and, in turn, attend to individual phonemes within words (Johnston et al., 1996).

Curricula that include explicit instruction on PA skills and alphabet skills simultaneously have been associated with larger gains than those that teach only PA (Piasta & Wagner, 2010; Whitehurst & Lonigan, 1998). In a comparison of alphabet knowledge instructional approaches, children acquired more letter sounds when instruction included letter names and corresponding sounds as opposed to sounds only (Piasta, Purpura, & Wagner, 2010). In a meta-analysis of more than 60 studies of alphabet instruction, small to moderate overall effects (.14–.65) were found for naming letters, letter-sound correspondence, and letter writing (Piasta & Wagner, 2010). Effect sizes were larger for small-group instruction than individual or whole-class instruction, although the difference between small-group and whole-class instruction was not statistically significant.

Multitiered System of Supports

Multitiered system of supports (MTSS) is a prevention and intervention model for providing supplemental instruction. MTSS is used by educators to monitor students through regular screening and dynamic progress monitoring and provides specific interventions. Often, interventions are delivered in three-tiered models in which services are complementary and students move among tiers (Marston, 2005). Tier 1 is *universal prevention* in which high-quality instruction is provided to all students (Vaughn & Chard, 2006). Tier 2 is *selective prevention* for students who have poor responses to Tier 1. Tier 2 generally consists of small-group instruction on specific areas of need (Vaughn & Chard, 2006). Tier 3 is *indicated prevention* and involves individualized, intensive services for students who have not responded to Tiers 1 and 2 instruction (Vaughn & Chard, 2006). The dearth of evidence-based interventions for school readiness skills hinders large-scale adoption of MTSS models in early childhood settings (Greenwood et al., 2011).

PAth to Literacy (Goldstein, 2016) was developed to fill the need for tiered early literacy supports in early childhood settings. Specifically, the PAth to Literacy curriculum was designed to fit the need for children with delays in emergent literacy skills as a Tier 2 intervention delivered to groups of three children. Researchers have shown this intervention to be effective for children in prekindergarten who demonstrate deficits in PA (Goldstein et al., 2017; Kruse, Spencer, Olszewski, & Goldstein, 2015). PAth to Literacy specifically addresses blending, segmenting, identifying first parts (i.e., first syllables) of words, and identifying first sounds (i.e., first phonemes) in words. Each scripted lesson follows a developmental sequence with modeling and targeted feedback, designed to provide instruction within each child's zone of proximal development (Vygotsky, 1978). Children are given frequent opportunities to respond in each lesson, with group response–contingent feedback provided for practice items. Scripts contain feedback for correct, incorrect, and no response categories. See Goldstein and Olszewski (2015) for a description of the development of PAth to Literacy.

An early efficacy study of PAth to Literacy used a multiple-baseline across-groups design (Kruse et al., 2015). All seven children demonstrated growth on the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Dynamic Measurement Group, 2006) First-Sound Fluency measure. However, there was no effect on measures of alphabet knowledge.

A subsequent cluster randomized design study conducted across three sites evaluated the efficacy of PAth to Literacy (Goldstein et al., 2017). Classrooms were randomly assigned to condition, and all children received daily teacher-led instruction in small groups. The PAth to Literacy group made larger gains on DIBELS First-Sound Fluency compared with a group receiving a vocabulary intervention ($d = 1.14$). Again, the PAth to Literacy group did not make significantly better gains than the comparison group on measures of alphabet knowledge. This may be because alphabet instruction was provided briefly at the beginning of lessons without being integrated within the rest of the curriculum. These results signal the need to revise the curriculum to include additional instruction on letter names and sounds.

Instructive feedback is one means of providing additional instruction within a scripted curriculum. Instructive feedback is defined as the presentation of additional instruction after providing positive feedback on trials of direct instruction (Werts, Wolery, Holcombe, & Gast, 1995). Simply put, it is a way of modeling extra, nontargeted information while providing learner feedback. On targeted information, learners are not prompted to respond; therefore, they may acquire skills via observational learning. According to social learning theory, observational learning occurs when behaviors are modeled during social interactions and later reproduced by the learner (Bandura, 1977). Werts and colleagues (1995) conducted a review of 23 studies analyzing instructive feedback and determined that learners acquired the behaviors modeled during instructive feedback and maintained performance on those behaviors. These studies included children aged 3–21 years with and without disabilities. Examples of behaviors targeted include picture naming (Wolery et al., 1991), identifying and spelling sight words (Wolery, Schuster, & Collins, 2000), naming the United States (Werts, Caldwell, & Wolery, 2003), and labeling numerals (Holcombe, Wolery, Werts, & Hrenkevich, 1993). The addition of instructive feedback only slightly increased the length of instructional sessions and did not seem to interfere with the learning of target behaviors (Werts et al., 1995). In addition, Werts and colleagues (2003) found that children demonstrated learning of instructional

feedback targets at the same time they were acquiring instructional targets.

Given the importance of alphabet knowledge and limited success of teaching letter names and sounds with PAth to Literacy, this study sought to strengthen this curricular component. The purpose of the current study was to investigate the use of instructive feedback for modeling letter names and corresponding sounds. Instructive feedback has not previously been studied within the context of PA or alphabet knowledge interventions. It was hypothesized that integrating the alphabet instruction into the PA curriculum would help children master alphabet skills. Because of the frequent use of feedback already written into the curriculum, there were many opportunities in each lesson to model new skills during instructive feedback events. Directly assessing discrete PA skills taught in PAth to Literacy allowed a unique opportunity to demonstrate experimental control for the learning of skills as they were introduced into the curriculum using a multiple-baseline design. The following research questions were addressed:

1. Do children acquire letter names and corresponding sounds modeled during instructive feedback over the course of the intervention as measured by an Alphabet Mastery Probe?
2. Do children acquire letter names and corresponding sounds modeled during instructive feedback as measured by standardized, distal assessments?
3. Do children demonstrate growth on discrete PA skills (blending, segmenting, first-part identification, first-sound identification) taught in individual units of the intervention, as measured by a researcher-developed PA Fluency Probe?
4. Do children demonstrate growth in PA as measured by standardized, distal assessments?

Experiment 1

Method

Participants

Participants selected were aged 4–5 years who fit the profile of Tier 2 candidates because of persisting deficits in PA and letter-sound knowledge. Demographic information is provided in Table 1. Participants attended three local childcare classrooms that offered prekindergarten services. Classrooms were chosen based on the teacher's willingness to participate and his or her lack of established Tier 2 curriculum for early literacy skills. The study took place during the spring semester, thus allowing children ample exposure to the general class curriculum. In Classroom 1, two of the participants' families reported income below the federal poverty line. Families in Classrooms 2 and 3 chose not to provide information on household income, but the classrooms were in high-poverty neighborhoods. None of the children had identified speech-language disorders. All parents reported reading with their children regularly.

Table 1. Experiment 1 participant characteristics.

Name	Classroom	Age (at pretest)	Gender	DLL	Ethnicity
Kevin	1	4;6	M	Y	Hispanic
Andre	1	5;2	M	Y	Hispanic
Diego	1	4;9	M	Y	Hispanic
Dominic	2	4;3	M	N	African American
Lucas	2	4;6	M	N	African American
Mario	2	4;6	M	N	Other/multiracial

Note. DLL = dual-language learner.

All children with parental consent were screened using the researcher-developed PA Fluency Probe and Alphabet Mastery Probe. Consenting and research procedures were approved by the Institutional Review Board at the University of South Florida (IRB Pro13660). At least three rounds of screenings over a 2-week period were used to monitor PA and alphabet skills during the baseline phase. A total of nine children (three in each classroom) who scored low on both measures with no sign of growth after three rounds of screening were included. To qualify, each child knew fewer than five of eight possible letter names and sounds on each unit of the Alphabet Mastery Probe. This cut score was chosen to include children who previously acquired some letter names and sounds but had the potential for growth. Furthermore, children scored five or fewer on each subtest of the PA Fluency Probe, indicating the need for Tier 2 support in PA.

In Classroom 3, two children left the classroom during the baseline phase. The third student's attendance was very inconsistent, making it difficult to deliver lessons regularly. Therefore, this classroom was not included in the treatment phase of the study. All children in Classrooms 1 and 2 completed the intervention and posttesting.

Classroom teachers served as the interventionists. In Classroom 1, the teacher left her job prior to starting the first lesson. Because a permanent teacher had not been identified, an undergraduate in communication sciences and disorders with previous childcare experience served as the interventionist. The first author was responsible for training interventionists and assessors. Interventionist training lasted approximately 1 hr and was conducted one-on-one in the classrooms. Research staff responsible for conducting assessments included a doctoral student and three undergraduate students in communication sciences and disorders. All research staff demonstrated 100% fidelity on the assessments prior to working with participants.

Intervention

Children received small-group instruction with a modified version of the PAth to Literacy intervention (Goldstein, 2016). The modified intervention separated instruction into four units: blending, segmenting, first-part identification, and first-sound identification. Each unit contained three parallel lessons with the same instruction but different target words. If children did not demonstrate

mastery of the skills following the three lessons, the cycle was repeated until mastery was observed. Mastery was defined as all children in the group correctly responding to 80% or more of the prompts in two separate lessons. Instruction moved from larger units to smaller units. For example, the blending and segmenting units progress from the compound word level to syllable level to onset rime of one-syllable words. The first-parts unit includes two-syllable words, whereas the first-sounds unit includes a mix of one- and two-syllable words.

Each lesson consisted of 16–22 target items and took approximately 10 min. Children participated in one lesson per day for 15–21 days (depending on attendance and group performance). The target PA skill was modeled repeatedly in each lesson. Instruction progressed from interventionist modeling to guided practice to independent practice. Visuals and gestures were used at the beginning of each lesson and then faded to provide children independent practice opportunities. Contingent feedback was provided for each trial. See Appendices A and B for the scope and sequence and a sample script.

Teachers were taught to read each script verbatim. With each item, scripted feedback was provided for correct, incorrect, and nonresponses. Feedback was contingent on group responses, with children responding simultaneously in a choral fashion. If the group responded correctly, the response was reinforced and an instructive feedback target was modeled. If at least one member of the group responded incorrectly (or did not respond), corrective feedback included a model of the correct response, additional instruction, and an opportunity for the children to respond again. For each target item, children received up to two rounds of feedback and opportunities to respond. Once all children responded correctly or the teacher provided two rounds of feedback, instruction progressed to the next item.

Instructive feedback was integrated by modeling letter names and sounds following correct group responses to PA tasks. Immediately following the positive feedback, teachers presented the first letter of the target word as instructive feedback. Given that children had multiple opportunities to respond following feedback on items, instructive feedback was given on almost every trial. During instructive feedback, the teachers held up a card with the initial letter of the target word and said the name and the corresponding sound. For example, if the word was *blueberry,* during instructive feedback, the teachers held up a card depicting "Bb" and said, "The letter B makes the /b/ sound." Children were not asked to respond to this portion.

Each of the four units contained instructive feedback, and four individual letters were modeled, for a total of 16 letters. All items in a unit began with those four target letters for multiple exposures to each letter. The selected letters were consonants commonly used in the word-initial position. Three versions of the PAth to Literacy script were created to counterbalance the letters associated with each PA unit. That is, the target words within each PA unit were changed so that the words began with the letters of a different letter set. The three versions of the script were created so the order in which letters were introduced was not a confounding variable. Although each group progressed through the PA units in the same developmental sequence, the letters were introduced in a different order for each group (see Table 2).

Units were modified into themes to emphasize the discrete PA skills being taught in each lesson. For example, the blending lesson was presented using a finger puppet, Bobby the Blending Bear. Throughout the units, instruction was added to remind the children of the task they were performing, including a short definition (e.g., "Bobby Bear likes blending. Blending is when you put little parts of words together to make whole words."). It was hypothesized that this additional instruction and graphic cue would help children generalize the skills to the researcher-developed and standardized measures of PA.

Measurement

Alphabet Mastery Probe. Alphabet skills were assessed using the Alphabet Mastery Probe. This is a researcher-developed assessment that measures letter naming and letter-sound correspondence for the 16 letters modeled in the intervention. Children were shown a card with the uppercase and lowercase letter. Children earned one point for correctly naming the letter and one point for producing the phoneme associated with that letter. This measure was used as the primary outcome measure for alphabet knowledge modeled through instructive feedback. All letters were presented with each administration, and scores were calculated for each letter set.

PA Fluency Probe. PA skills were measured using a researcher-developed PA Fluency Probe (Appendix C) with four subtests: Blending, Segmenting, First-Part Identification, and First-Sound Identification. The subtests were introduced by a finger puppet corresponding with the PAth to Literacy unit. Once the skill was introduced and modeled, children demonstrated the skill with as many words as possible in 1 min. Each subtest had a maximum score of 20. Three parallel versions of the PA Fluency Probe were created with different target words.

The subtests matched the corresponding instructional unit. The Blending and Segmenting subtests required children to blend or segment at the syllable or onset-rime level for one- or two-syllable words. The First-Parts subtest required students to identify the first syllable or onset of a two-syllable word. The First-Sounds subtest required students to identify the initial phoneme of a one- or two-syllable word, including words with initial consonant clusters.

TOPEL. The Phonological Awareness and Print Knowledge subtests of the Test of Preschool Early Literacy (TOPEL; Lonigan, Wagner, Torgesen, & Rashotte, 2007) were used at pretest and posttest as distal measures of PA and print knowledge. The Phonological Awareness subtest measures a child's ability to complete tasks of blending and elision from the syllable to the individual phoneme level. The Print Knowledge subtest includes items measuring letter identification, letter-sound correspondence, and understanding the use of print in text.

Table 2. Phases of data collection.

Classroom	Baseline	Unit 1	Unit 2	Unit 3	Unit 4	Maintenance
1	Four sessions	Blending Letter Set A (B, C, J, T)	Segmenting Letter Set B (D, G, H, K)	First syllable Letter Set C (F, L, N, W)	First phoneme Letter Set D (M, P, R, S)	
2	Seven sessions	Blending Letter Set D	Segmenting Letter Set C	First syllable Letter Set B	First phoneme Letter Set A	
3	10 sessions	Blending Letter Set B	Segmenting Letter Set A	First syllable Letter Set D	First phoneme Letter Set C	

DIBELS First-Sound Fluency. The DIBELS First-Sound Fluency measure served as a distal measure of PA (Dynamic Measurement Group, 2006). In this 1-min fluency measure, children received two points for producing the initial phoneme and one point for producing the initial blend of a word. Although traditionally used with older children, previous researchers have found success using this measure with preschoolers (Goldstein et al., 2017; Kruse et al., 2015). Alternate form reliability is .82, and predictive validity with the DIBELS Phoneme Segmentation Fluency and Nonsense Word Fluency is .46–.51 and .41, respectively (Cummings, Kaminski, Good, & O'Neil, 2011).

Letter Sound Short Form Assessment. The Letter Sound Short Form Assessment (Piasta, Phillips, Williams, Bowles, & Anthony, 2016) served as a distal measure of alphabet knowledge. This is a brief measure of letter-sound knowledge developed for young children. There are three alternate forms with eight letters each. Children were asked to produce the sounds corresponding with those letters. Alternate form reliability for this measure is high (.89–.93).

Clinical Evaluation of Language Fundamentals–Preschool 2. The Clinical Evaluation of Language Fundamentals–Preschool 2 (Wiig, Secord, & Semel, 2004) Core Language Score served as a descriptive measure of child language ability at pretest. Guidelines for African American and Spanish dialects were used.

Experimental Design

A multiple-baseline design across behaviors (i.e., units of instruction) was used (Kennedy, 2005). In this design, four sets of letters were introduced sequentially such that baselines were extended for letter sets presented later in the curriculum. That is, for experimental control, all letters were not introduced at the same time. The primary outcome measure was the Alphabet Mastery Probe. Low and stable baselines from individual children (at least three points) were obtained prior to treatment. The treatment consisted of four phases, corresponding to the four units of instruction in PAth to Literacy.

Visual analyses of the data were conducted at the student level to evaluate whether improvements occurred predictably as instruction was introduced. Ideally, each child demonstrated low and stable scores during baseline with no indication of an upward trend. Upward trends for each letter set of the Alphabet Mastery Probe following the start of instruction on that respective unit, coupled with little overlap of scores between baseline and intervention or maintenance phases, indicated that students acquired new skills via instructive feedback. There was a potential for effects to be replicated across six participants.

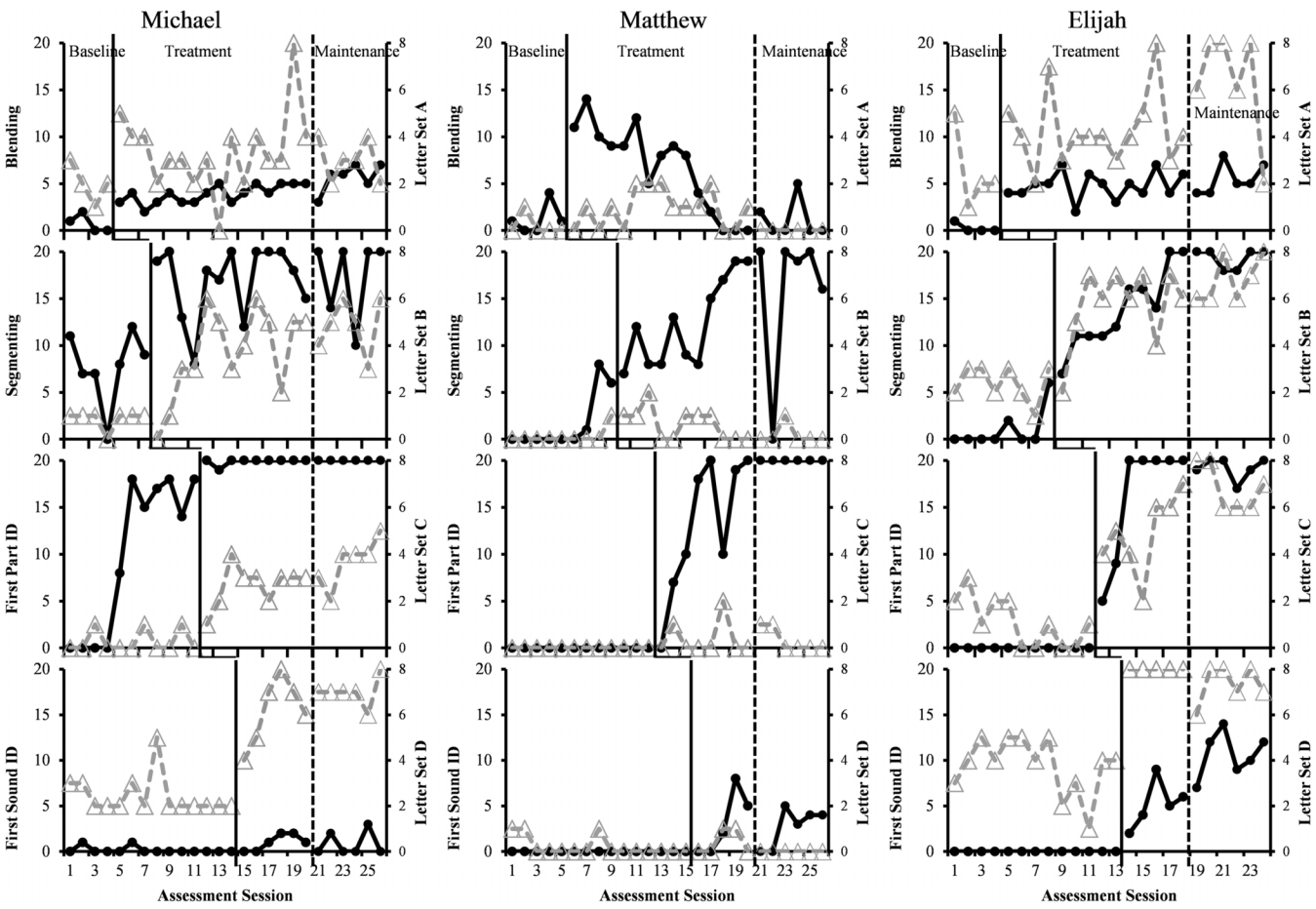
Effect sizes were estimated using the improvement rate difference (IRD) scoring method (Parker, Vannest, & Brown, 2009). IRD scores were determined by calculating the ratio of improved data points to total points during the treatment phase and subtracting the ratio of improved data points to total data points during the baseline phase (Parker et al., 2009). For example, in Kevin's Letter Set A scores in Figure 1, one of his three baseline points was improved (higher than a treatment point). Twelve of his 15 treatment phase points were improved (higher than the baseline points that were not improved). Therefore, the IRD calculation for this individual phase was 12/15 – 1/3 = .46. Effect sizes were estimated for each child and then aggregated to calculate an overall effect size for the Alphabet Mastery and PA Fluency Probes.

Pretest and posttest scores on the TOPEL Print Knowledge subtest and the Letter Sound Short Form Assessment served as distal measures of alphabet knowledge. Pre–post comparisons were conducted using paired-samples *t* tests to answer the second research question.

To determine whether children demonstrated gains on PA skills consistent with instruction, a multiple-baseline design across participants was used (within groups; Kennedy, 2005). There was the potential for six replications. There were four treatment phases of this design, with each phase corresponding to a unit of instruction in PAth to Literacy. The PA Fluency Probe served as the primary outcome measure. Because children were grouped, random assignment of groups to staggered lengths of baseline phases reduced threats to internal validity (Kratochwill et al., 2010). Visual analyses of the data were conducted at the student level to evaluate whether improvements occurred predictably according to the multiple-baseline design. Upward trends for each subtest of the PA Fluency Measure following the start of instruction on that respective unit, coupled with little overlap of scores between baseline and intervention or maintenance phases, indicated that students were acquiring the skills taught during the intervention (Kennedy, 2005).

Pretest and posttest scores on the TOPEL PA subtest and the DIBELS First-Sound Fluency assessment served as descriptors of overall PA growth. Pre–post comparisons were conducted using paired-samples *t* tests to answer the fourth research question.

Figure 1. Experiment 1, Classroom 1 results.



Procedures

Teacher training consisted of a one-on-one meeting to review lesson materials and practice delivering lessons. Teachers received a manual that included comprehensive instructions for delivering lessons. A follow-up meeting was conducted in which the teacher was observed delivering part of a lesson. This provided an opportunity to ensure teachers were able to deliver practice lessons with at least 80% fidelity. Ongoing support was provided throughout the study, with researchers observing lessons weekly. Teachers required minimal support to deliver lessons; therefore, a comprehensive coaching plan was not used.

The study was completed in three phases:

Baseline phase. During the baseline phase, children were tested every second day using the PA Fluency Probe and the Alphabet Mastery Probe. Researchers conducted the screenings with each child individually. Each testing session lasted approximately 5–10 min. All participants demonstrated low, stable baselines on subtests of both measures. This helped ensure children were not making gains because of maturation or repeated testing. Once at least three stable baseline data points were collected for children in Classroom 1, those children entered the treatment phase. Because of absences, there are differences in the number of assessment points children within the same group received. Baseline testing continued for Classroom 2 until children in Classroom 1 demonstrated gains on the PA Fluency and Alphabet Mastery Probes. Therefore, children in Classroom 2 received up to three additional baseline points.

Treatment phase. Intervention was delivered in groups of three children by teachers 3 to 5 days per week. Teachers recorded individual responses to each prompt using a provided data sheet for progress-monitoring purposes. Children continued to rotate through the parallel lessons of each unit until mastery on the lessons was demonstrated by the group. Children received a minimum of three lessons per unit regardless of performance. Upon completion of one unit, children progressed to the subsequent unit, until all four units were completed. Children were assessed by the researcher staff using the Alphabet Mastery and PA Fluency Probes following every second day of instruction. Absences account for individual differences in the number of assessment points across children within classrooms. It is important to note that progression through the units was dependent on lesson performance,

not probe data. This was done to encourage progression through the curriculum and not repeat unnecessary instruction. Therefore, there were instances of rising or unstable baselines that were not extended.

Maintenance phase. Upon completion of the intervention, children were assessed using the probes an additional two to three times to document maintenance of skills acquired during the intervention. The TOPEL subtests, DIBELS First-Sound Fluency, and Letter Sound Short Form also were administered at posttest.

Fidelity and Reliability

Teachers were observed during 14 of the 42 (33%) lessons to score implementation fidelity using an eight-item observation checklist. Scoring was done in the classroom by the first author. The checklist included procedures deemed to be crucial to lesson delivery including reading the target items correctly, providing the correct type of feedback, reading the script verbatim, and encouraging positive child behaviors. Certain procedures were weighted more heavily based on perceived importance to lesson delivery; thus, teachers earned multiple points for following those procedures. Percentages were calculated by dividing the total number of observed procedural points by the total number of possible procedural points. The range of fidelity of implementation scores was 80.5% to 98.6%, with a mean of 93.0%.

A sample (20%) of the Alphabet Mastery Probe and PA Fluency Probe administrations were randomly selected and assessed for fidelity of implementation and scoring reliability. To determine fidelity of implementation, a trained research assistant blind to the child's identity and phase in the study completed a checklist of procedures. The fidelity of the Alphabet Mastery Probe was 100%. The fidelity of the PA Fluency Probe range was 94% to 100%, with a mean of 99%.

Interrater reliability was determined by rescoring 20% of the assessments. The presentation of letters on the Alphabet Mastery Probe was random, so the sessions could not be rescored from audio recordings. Thus, interrater reliability could not be calculated. Item-level agreement was calculated for the PA Fluency Probe by comparing the original and rescored items. The mean score and range of scores for each subtest were calculated as follows: Blending (M = 95%, 62%–100%), Segmenting (M = 97%, 83%–100%), First-Part Identification (M = 99%, 67%–100%), and First-Sound Identification (M = 97%, 67%–100%). Although the mean reliability was very high, several sessions had low scores. These low-reliability scores were observed in sessions in which children responded to only a few items and there was a discrepancy between one or two of the items. Some of the sessions were difficult to score because of background noise on the audio recordings. This contributed to some of the lower interrater reliability scores.

Results

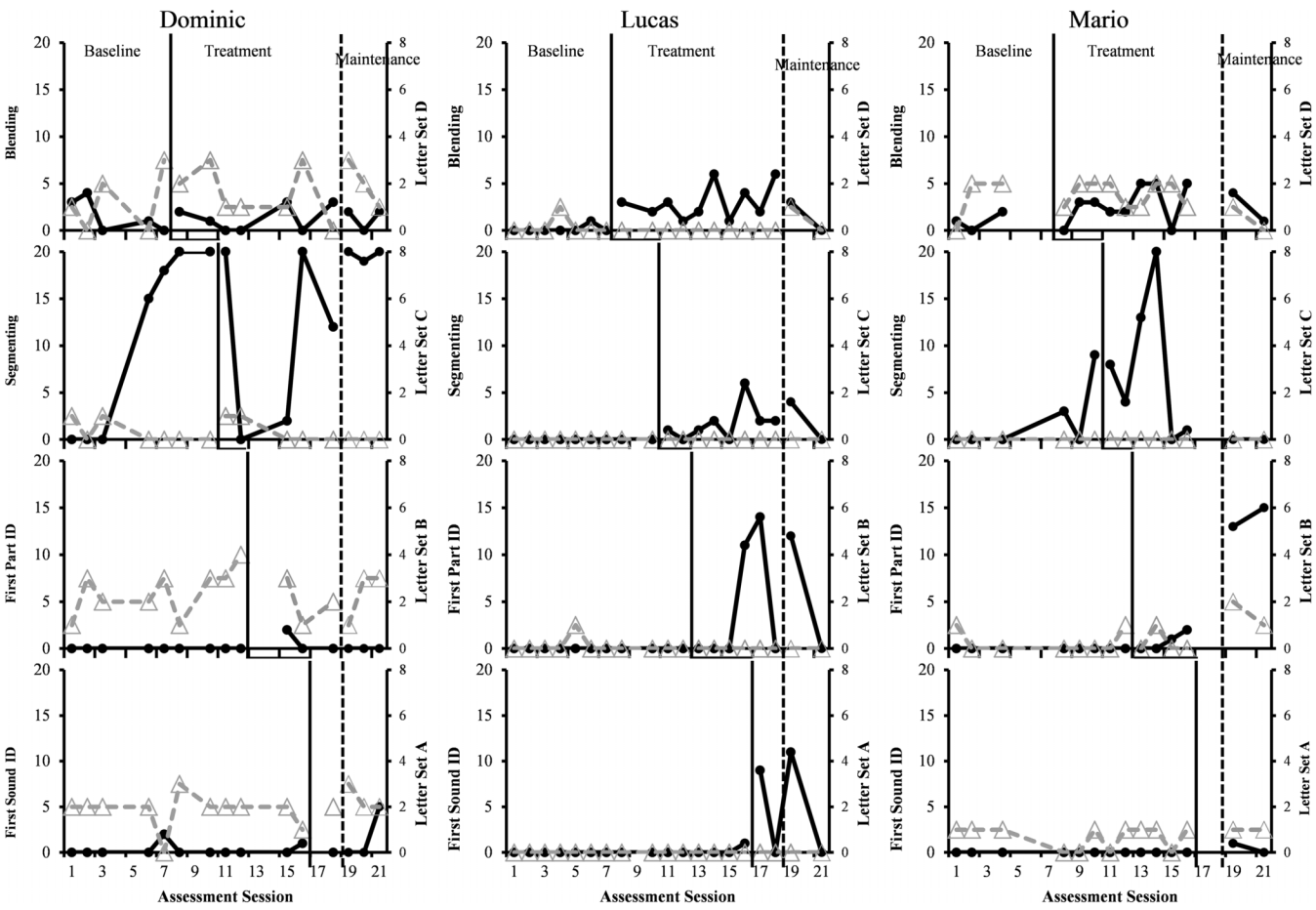
Child performance on the primary outcome measures, Alphabet Mastery Probe and PA Fluency Probe, are presented graphically in Figures 1 and 2. Each graph simultaneously depicts each child's performance on the two measures. The horizontal axis represents assessments over time. The left vertical axis represents PA Fluency Probe scores, which are indicated by black circles and the solid line. The right vertical axis represents Alphabet Mastery Probe scores, which are indicated by gray triangles and the dashed gray line. The solid vertical line shows the start of instruction on that target unit. The dashed vertical line indicates the maintenance phase.

To determine whether children acquired letter names and corresponding sounds modeled during instructive feedback, results on the Alphabet Mastery Probe were analyzed. Dominic, Lucas, Mario, and Kevin did not demonstrate gains on letter names or sounds following introduction of instruction. That is, there were no significant differences between baseline and intervention phases for each unit of instruction. Kevin showed overall improvement, but experimental control was lost, as he demonstrated gains during the baseline phase. Andre and Diego demonstrated small gains from baseline on letter-sound knowledge corresponding to treatment, particularly for Letter Sets A, B, and D. Effect sizes were estimated using IRD (see Table 3). Although the participants demonstrated gains on the Alphabet Mastery Probe, the gains were not greater than chance, as indicated by an average effect size of .32. This corroborates the finding from visual analysis of Figures 1 and 2, which failed to show consistent improvements on the Alphabet Mastery Probe. Similarly, children did not show significant gains on distal measures of alphabet knowledge (see Table 4): Letter Sound Short Form, $t(5) = 0.83$, $p = .44$, Cohen's $d = 0.50$, or TOPEL Print Knowledge, $t(5) = 1.93$, $p = .11$, $d = 0.78$.

To determine whether children acquired PA skills taught during lessons, scores on the PA Fluency Probe were analyzed. Andre and Lucas demonstrated gains across all four units, although some were delayed. Dominic showed improvement in segmenting, but because this was noted during baseline, the gain cannot be attributed to the intervention. The remaining children demonstrated gains consistent with treatment for two or three of the PA units. Across the PA units, gains on the Blending and First-Sound subtest were more modest and unstable. Effect size estimates (see Table 3) further support the claim that children demonstrated gains on the PA Fluency Probe. All children demonstrated positive effect sizes, and only Dominic scored below the level of chance (.50). The overall effect size estimate of .65 indicates that children demonstrated meaningful gains across phases of the study consistent with treatment.

Distal measures of PA (see Table 4) corroborated the results on the PA Fluency Probe. For example, all children demonstrated gains on the DIBELS First-Sound Fluency, with five of the six children scoring above the kindergarten benchmark (10). Mario was the only child who did not meet the kindergarten benchmark, although he still gained seven points. As a group, children demonstrated significant gains on First-Sound Fluency, $t(5) = 5.65$, $p < .01$, $d = 3.34$. All children demonstrated gains on the TOPEL Phonological

Figure 2. Experiment 1, Classroom 2 results.



Awareness subtest, $t(5) = 4.79$, $p < .01$, $d = 2.01$. Gain scores ranged from 3–30 points, with a mean gain of 17. The combined results of the PA Fluency Probe, the DIBELS First-Sound Fluency, and the TOPEL Phonological Awareness subtest indicate that PA instruction in PAth to Literacy was efficacious.

Discussion

The main purpose of this study was to determine whether children acquired alphabet skills that were introduced as instructive feedback during a PA curriculum. Although children demonstrated significant gains on PA skills, overall they did not demonstrate gains on letters modeled via instructive feedback. Therefore, instructive feedback alone does not seem sufficient for teaching letter names and sounds. It seems that more intensive, carefully planned instruction is necessary for teaching alphabet skills.

Table 3. Effect sizes for Experiment 1.

Child	Alphabet Mastery Probe	PA Fluency Probe
Kevin	.46	.56
Andre	.45	.67
Diego	.55	.81
Dominic	.19	.31
Lucas	–.02	.75
Mario	.41	.61
Total	.32	.65

Note. PA = phonological awareness.

There are several reasons why the instructive feedback may not have been effective. First, children were not required to respond. Consequently, the children may not have attended to the presentation of letter names and sounds. Given the promising results of other alphabet intervention studies (Piasta & Wagner, 2010), it seems that observational learning may not be sufficient for children to acquire letter names and corresponding sounds. Active learning, in which children have an opportunity to engage and practice, may facilitate acquisition of modeled targets (Bandura, 1977). Second, children may have had difficulty discriminating letters. All children responded appropriately to prompts during assessment with the Alphabet Mastery Probe. That is, they all provided names and sounds of letters. However, they often provided the wrong name or sound for letters. This indicates that children may have had difficulty discriminating the different letters

Table 4. Pretest and posttest scores for Experiment 1.

Child	LSSF Pre	LSSF Post	FSF Pre	FSF Post	TOPEL PK Pre	TOPEL PK Post	TOPEL PA Pre	TOPEL PA Post	CELF	Total Lessons
Kevin	0	4	4	17	88	112	71	87	69	19
Andre	0	0	0	14	74	78	71	87	63	18
Diego	2	3	0	12	94	111	85	104	79	20
Dominic	3	1	0	10	89	87	87	90	98	15
Lucas	0	0	0	24	86	89	63	93	79	21
Mario	1	2	0	7	82	84	87	104	90	16

Note. LSSF = Letter Sound Short Form raw scores; FSF = Dynamic Indicators of Basic Early Literacy Skills First-Sound Fluency raw scores; TOPEL = Test of Preschool Early Literacy standard scores; PK = print knowledge; PA = phonological awareness; CELF = Clinical Evaluation of Language Fundamentals–Preschool 2 Core Language standard scores.

of the alphabet. Third, several children exhibited a repetitive, stereotypic pattern of responses during the alphabet assessments. That is, these children repeated the names and sounds of the same letter throughout the assessment. This may have been due to children being bored, frustrated with testing, or confused by the task.

Dominic was the only child who did not demonstrate gains on units of PA instruction. He often exhibited a pattern of stereotypic behaviors during testing. For example, throughout the testing sessions, he would often say "horsey" for each item on the assessment. The discrepancy between his performance on lessons and assessments indicates that his behavior with the researcher may have affected his performance. During observations of the lessons, he was more attentive and responsive to the teacher than the researcher.

Teachers indicated satisfaction with the intervention. Teachers agreed that the intervention was easy to learn and feasible to deliver in the classroom. One of the teachers did not agree that the instructive feedback for alphabet skills was beneficial for children; the other teacher slightly agreed with that statement. However, both agreed that children acquired PA skills via the intervention. This indicates that the intervention was appropriate for teaching some early literacy skills to preschoolers, but modifications are necessary to make the curriculum more engaging and, in the case of alphabet skills, more effective.

Previous research has shown that combined PA and alphabet knowledge interventions are generally more effective than stand-alone interventions. Although instructive feedback might not be sufficient for children to learn alphabet skills, the amount of time and effort the instructive feedback added to the curriculum was minimal. Therefore, instructive feedback to reinforce alphabet skills may be a useful part of a broader early literacy curriculum. To further understand why children did not demonstrate gains on measures of alphabet knowledge, a second experiment was conducted.

Experiment 2

Given that children did not acquire letter names and corresponding sounds via observational learning in Experiment 1, a second experiment was designed to investigate a more active learning approach. Alphabet skills, again, were taught via instructive feedback; however, a progressive time delay was incorporated to allow children an opportunity to practice letter names and sounds during the lessons. Experiment 2 evaluated whether incorporating a progressive time delay was effective. Using a progressive time delay, the interventionist selected the letter from a field of four, thus modeling a discrimination task for the child. Progressive time delay is an efficient method for teaching discrimination skills to young children (Wolery, Doyle, Gast, Ault, & Simpson, 1993). During initial presentation of the skill, there was no pause, and the interventionist simply modeled the target skill. However, with more exposures, the pause time was increased to shift stimulus control to the child with near-errorless learning (Handen & Zane, 1987; Snell & Gast, 1981).

Another issue that arose with Experiment 1 was a stereotyped pattern of responses due to repeated testing. For example, some children seemed to learn the letter names and sounds during lessons but failed to identify them during assessments. For this reason, it was hypothesized that combining lessons and assessments into one session would promote generalization of skills to the assessments. Therefore, the instructional format was changed from small groups to one-on-one. For feasibility purposes, researchers served as interventionists in Experiment 2.

The purpose of Experiment 2 was to determine whether the modifications to the presentation of instructive feedback resulted in gains in alphabet skills. It was hypothesized that by making learning more explicit and active, the progressive time delay would be beneficial and children would acquire letter names and sounds presented via instructive feedback. The experiment sought to answer the same research questions as Experiment 1.

Method

Participants

Nine additional children, aged 3–5 years, who demonstrated limited PA and letter-sound identification were recruited from an early childcare center. The study took place during the summer semester. All children completed at least 1 year of structured childcare prior to enrollment

in the study. Demographic information is presented in Table 5. One child, Matthew, received speech-language services and demonstrated signs of a phonological disorder. None of the other children had identified speech-language disorders. All parents reported reading to their children regularly. Danielle's family reported household income below the federal poverty line. Edgar's family did not report household income. Matthew, Brandon, Joshua, and Ben's families reported household incomes just above the federal poverty line. One participant, Danielle, left the childcare center during the final phase of the study.

Two doctoral students and one undergraduate student in communication sciences and disorders were responsible for delivering the intervention and assessments. These interventionists received individual training with the first author. In addition, all interventionists were observed to deliver the lessons and assessments with 100% fidelity prior to working with participants. The intervention and testing took place at the childcare center.

Intervention

Children received one-on-one instruction with the same version of the PAth to Literacy intervention used in Experiment 1. However, the alphabet instruction was modified to include a progressive time delay when introducing letter names and sounds during instructive feedback. For example, when letter names and sounds were modeled during the instructive feedback phase, the interventionist paused to allow children the opportunity to produce the name and sound of the letter independently (e.g., "This is the letter [pause] B. It makes the [pause] /b/ sound."). As each student moved through the lesson, the delay increased from 1–3 s to facilitate independent productions. The scripts indicated points in the lesson where the delay should be increased. If children produced the incorrect letter name or sound, the interventionist modeled the correct response and moved on with the lesson. During the alphabet instructive feedback, the interventionist identified the letter from a field of four. That is, all four letters from the unit were laid out, and the interventionist pointed to the specific letter during instructive feedback. This was done to help children discriminate among the letters in each unit.

Table 5. Experiment 2 participant characteristics.

Child	Age (at pretest)	Gender	DLL	Ethnicity
Michael	4;3	M	N	African American
Matthew	4;2	M	N	Other/multiracial
Elijah	3;9	M	N	Hispanic
Edgar	4;7	M	N	Hispanic
Danielle	4;3	F	N	Hispanic
Jose	3;11	M	N	Hispanic
Brandon	4;8	M	N	African American
Joshua	5;7	M	N	African American
Ben	4;8	M	N	African American

Note. DLL = dual-language learner.

Measurement

The measures used were the same as those described in Experiment 1. Based on test fatigue observed in Experiment 1, the assessments in Experiment 2 were presented in a gamelike format. A variety of "games" were incorporated, such as having the children "fish" the letters out of a pond or "feed" the letters to a friendly monster character.

Experimental Design

The research questions were addressed using a multiple-baseline across–units of instruction design, similar to Experiment 1. The four units of PA served as the treatment phases. The three alternate versions of the script, which included different target words, served to counterbalance the instructive feedback targets across groups of letters. Because letter units were counterbalanced, baselines were not staggered across children as in Experiment 1. Therefore, progression across units was determined at the individual level, rather than the classroom level. Once children demonstrated gains on the PA and alphabet skills targeted during a phase, instruction moved to the next phase until the curriculum was complete. There was a potential for effects to be replicated across nine individuals.

Procedures

Children were randomly assigned to one of the three versions of the curriculum and received a maximum of nine lessons per unit. For Edgar, Danielle, and Jose, interventionist error resulted in a collapsing of the first two treatment phases. These children received a lesson from the segmenting unit while they should have remained on the blending unit. After this day, the children continued to receive instruction on blending, as planned. However, we collapsed the phases in the depiction of the results to avoid misrepresenting the data. Children were assessed at six points over a 2-week maintenance period following the intervention.

Fidelity and Reliability

Fidelity of implementation for the intervention was scored as described in Experiment 1. The interventionists observed each other on a weekly basis and scored implementation fidelity in the classrooms for 48 of the 217 (22%) intervention sessions. Fidelity scores ranged from 87.5% to 100%, with a mean of 98.8%.

Fidelity of the Alphabet Mastery Probe and PA Fluency Probe was scored using the same method as Experiment 1, with 20% of the sessions randomly selected for scoring by the research assistant. The range of fidelity for the Alphabet Mastery Probe was 83% to 100%, with a mean of 99%. The range of fidelity for the PA Fluency Probe was 94% to 100%, with a mean of 99%. These results indicate high fidelity of implementation for the assessments in Experiment 2.

Interrater reliability was calculated for 20% of the assessment sessions. A research assistant blindly rescored 20% of the PA Fluency Probe administrations as described in Experiment 1. The reliability for each subtest was:

Blending (M = 94%, 67%–100%), Segmenting (M = 99%, 80%–100%), First-Part Identification (M = 99%, 85%–100%), and First-Sound Identification (M = 99%, 77%–100%). As in Experiment 1, low interrater reliability scores were observed for a few assessment sessions that were noisy or had a small number of child responses.

Results

Child performance on the Alphabet Mastery Probe and PA Fluency Probe is presented graphically in Figures 3–5. The final three data points for each child correspond with the 2-week maintenance period. Because Danielle left the study before completing the intervention and posttesting, her scores were not included in the discussion of distal measures.

For Alphabet Mastery Probes, treatment effects were evident for all children on at least three of the four treatment phases. These effects included low and stable baselines followed by improvements during treatment with little overlap between phases. Brandon and Joshua demonstrated rising baselines for some phases. Nevertheless, there was little overlap between baseline and treatment for each unit of instruction, indicating overall gains following treatment. Because preschoolers typically are taught letter name and sound knowledge, some gains during baseline are to be expected. The number of replications within and across participants in this experiment demonstrates a convincing experimental effect of the intervention on alphabet skills.

Effect sizes were estimated using IRD (see Table 6) and revealed that children made gains on the Alphabet Mastery Probe consistent with instruction. The overall effect size was calculated to be .75. This indicates that, overall, children made gains across phases at a level higher than chance. Only Matthew and Danielle scored at a level below chance. In general, effects were lower for the first unit of instruction than subsequent units.

All children demonstrated gains (one–seven points; see Table 7) on the Letter Sound Short Form, indicating that they acquired letter-sound knowledge during the study, $t(7) = 5.00$, $p < .01$, $d = 2.39$. Seven of the eight children demonstrated gains (3–25 points) on the Print Knowledge subtest of the TOPEL, $t(7) = 3.11$, $p < .05$, $d = 1.02$.

Results on the PA Fluency Probe were comparable with those of Experiment 1. All children demonstrated

Figure 3. Experiment 2, Classroom 1 results.

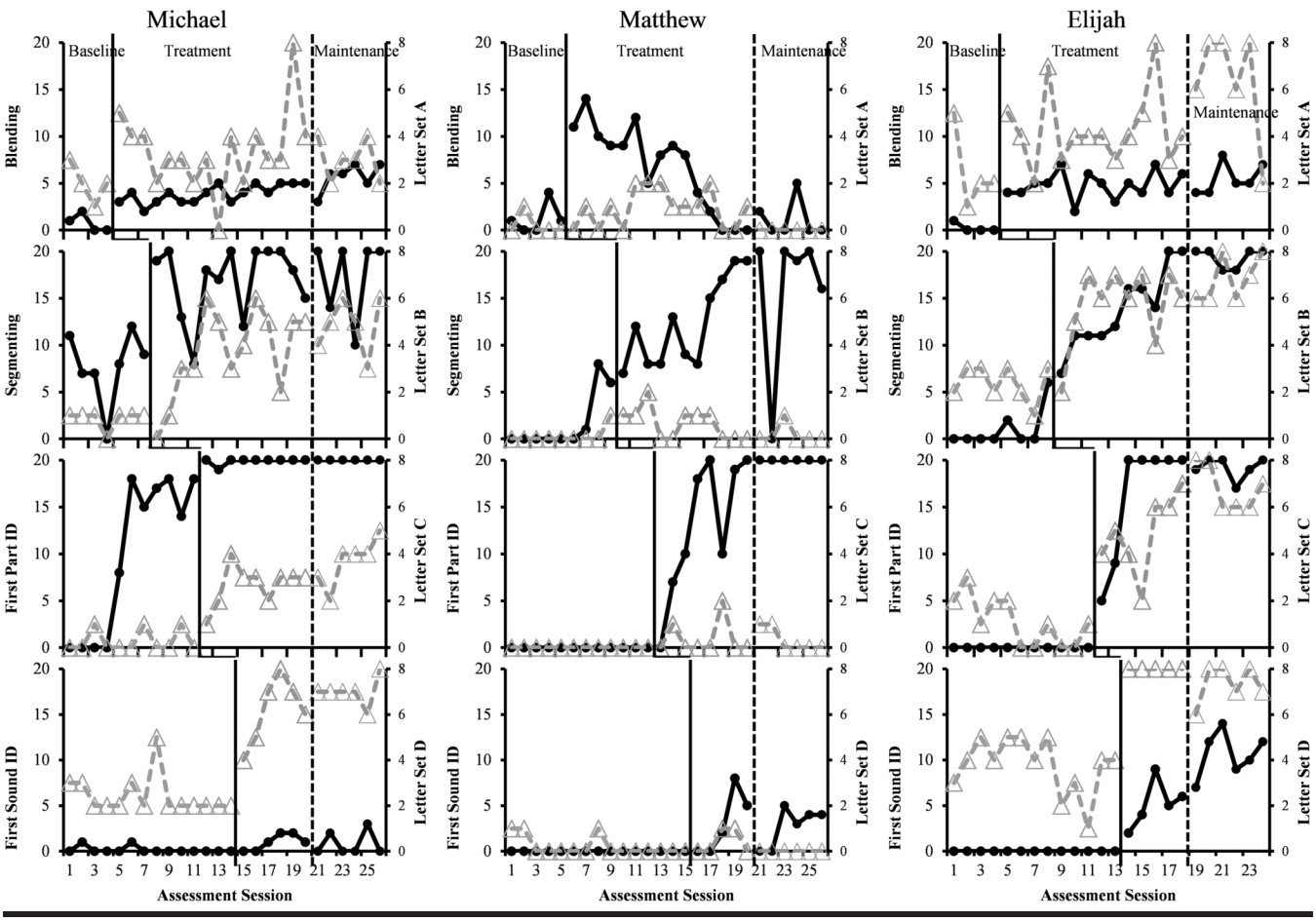
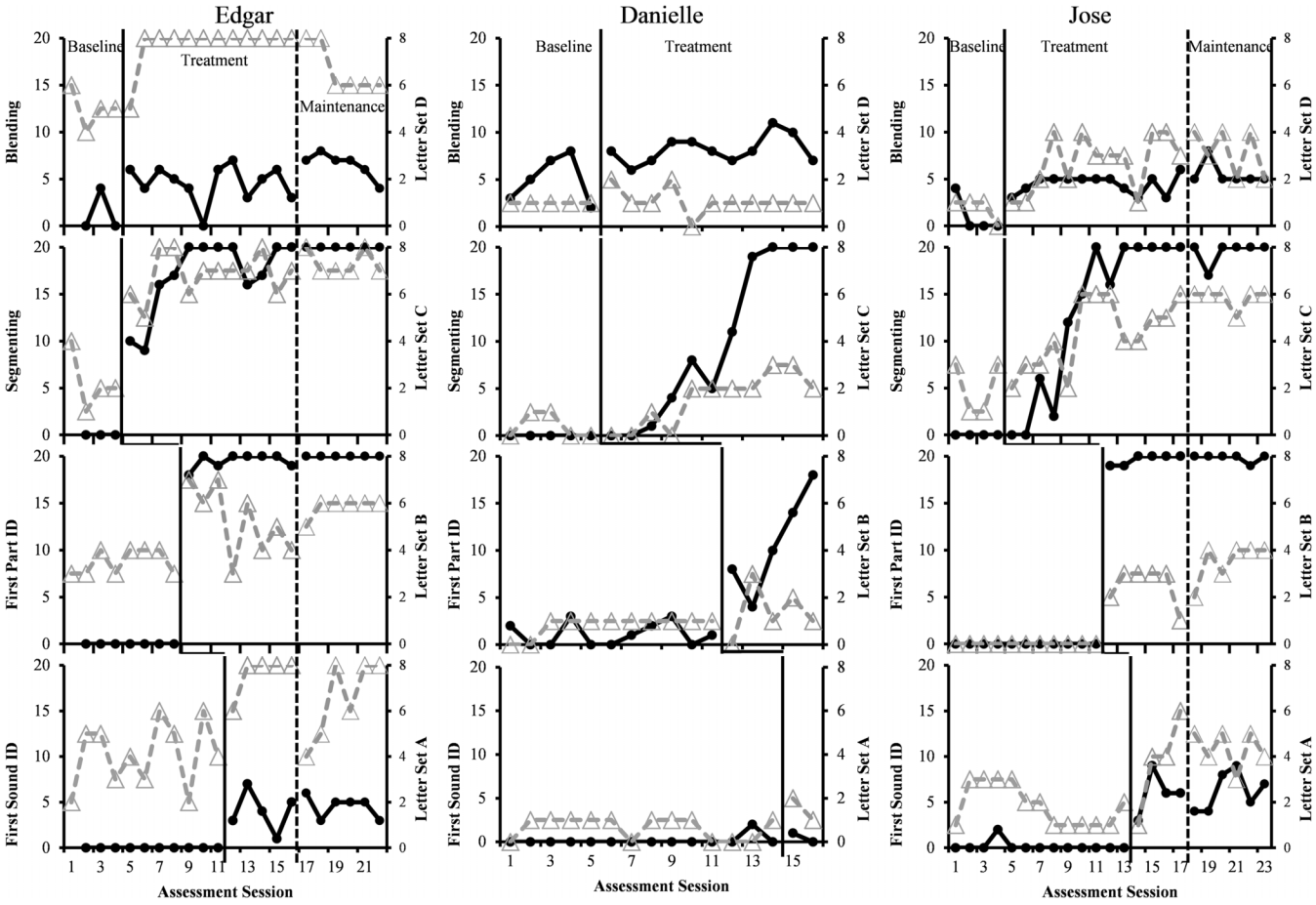


Figure 4. Experiment 2, Classroom 2 results.



effects for PA on at least three of the four treatment phases. Effects for blending were modest or nonexistent for some children (Joshua, Ben, Danielle, and Jose). Some children demonstrated gains on future units prior to instruction on that particular unit, as indicated by rising or unstable baselines (e.g., Matthew improved on segmenting during blending instruction).

Effect size estimates (see Table 6) confirmed the results of visual analyses of the data. An overall effect size of .83 was calculated using IRD. This indicates gains across treatment phases at a level higher than chance. Gains were replicated among all nine children. Many of the individual effect sizes were large. For example, Elijah's effect size of 1.00 indicates no overlap between baseline and treatment across all units of PA instruction. These results indicate that all children demonstrated meaningful gains on the PA Fluency Probe consistent with treatment.

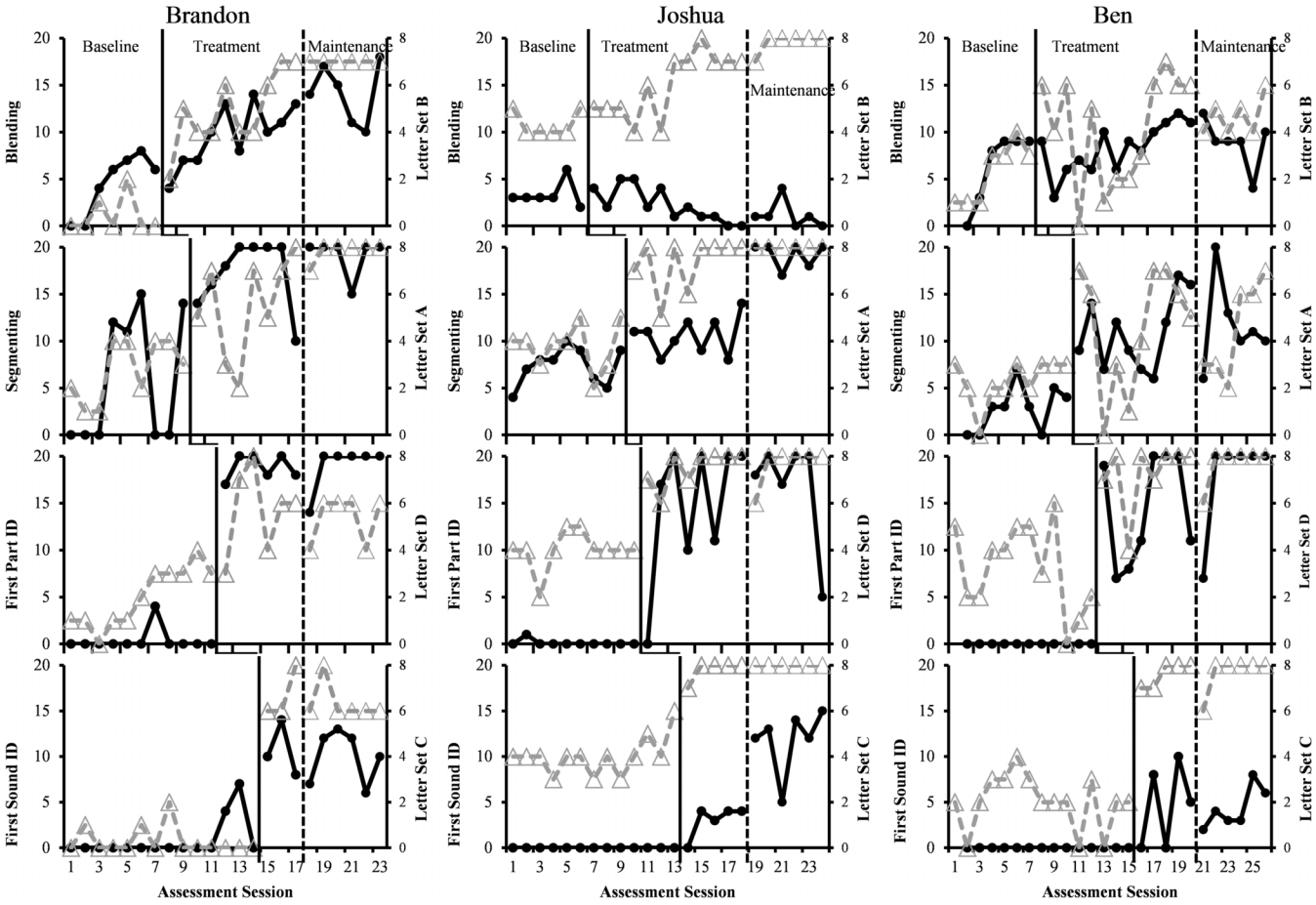
Results on distal measures of PA (see Table 7) corroborated gains on the proximal measures. All children demonstrated gains on the DIBELS First-Sound Fluency measure, $t(7) = 5.57$, $p < .001$, $d = 3.06$. Seven of the eight children met the kindergarten benchmark at posttest. All children demonstrated gains (5–30 points) on the TOPEL Print Knowledge subtest, $t(7) = 4.70$, $p < .01$, $d = 1.73$. The average gain was 14 standard score points, which is more than expected due to maturation. Overall, these results indicate that children improved their PA skills.

Discussion

The purpose of conducting the second experiment was to determine whether adaptations to the format of instructive feedback improved the acquisition of alphabet skills. The results indicate that all children learned names and sounds of letters consistent with treatment. In addition, all children demonstrated gains on PA measures. This experiment indicates that instructive feedback that includes a time delay strategy is a promising method for introducing alphabet knowledge during PA instruction.

Matthew made modest gains for Letter Sets A, B, and C and no gains for Letter Set D. He demonstrated a stereotypic response pattern, such as producing the same letter name and sound for each item on the assessment. He required frequent redirection, even with novel reinforcers and variations in gamelike formats. Danielle also demonstrated modest gains on the Alphabet Mastery Probe. At

Figure 5. Experiment 2, Classroom 3 results.



times, she disengaged from the task and did not respond for the remainder of the session. This resulted in scores lower than her perceived ability based on performance during lessons. Although all children demonstrated gains on alphabet knowledge measures, the number of letters and sounds learned varied for each student. Only Joshua learned all letters and sounds. Thus, although instructive feedback seems to be an appropriate means of introducing alphabet skills, it may need to be augmented with explicit instruction. Further, it is recommended that instructive feedback supplement, rather than replace, Tier 1 classroom instruction of letter names and sounds to help ensure children acquire all letter names and sounds.

Unstable baselines indicate that children acquired some PA skills before they were introduced. The related nature of these PA skills likely explains the loss of experimental control in these instances. That is, because both the blending and segmenting units require syllable-level awareness, children may have generalized skills before formal instruction began on segmenting. Gains on first-sound identification generally did not occur until instruction began on that unit, indicating a significant shift in ability as children move from the syllable to the phoneme level of awareness. The first-sound identification unit is the first in which children are required to perform phoneme-level awareness tasks. The progressive time delay strategy during instructive feedback events elicited verbal responses from all children in the study without explicit instructions to respond or imitate. Therefore, the appropriate shift in stimulus control was accomplished, although responses

Table 6. Effect sizes for Experiment 2.

Child	Alphabet Mastery Probe	PA Fluency Probe
Michael	.81	.77
Matthew	.24	.74
Elijah	.91	1.00
Edgar	.79	.94
Danielle	.41	.81
Jose	.85	.94
Brandon	.90	.81
Joshua	.89	.64
Ben	.75	.83
Total	.75	.83

Note. PA = phonological awareness.

Table 7. Pretest and posttest scores for Experiment 2.

Child	LSSF Pre	LSSF Post	FSF Pre	FSF Post	TOPEL PK Pre	TOPEL PK Post	TOPEL PA Pre	TOPEL PA Post	CELF	Total Lessons
Michael	0	2	0	2	97	115	101	109	106	28
Matthew	0	1	0	18	86	94	87	106	84	26
Elijah	1	6	0	22	113	122	87	98	84	26
Edgar	3	5	2	10	96	107	85	96	98	21
Danielle	0	—	0	—	93	—	95	—	96	23
Jose	0	3	0	19	104	102	95	117	90	25
Brandon	0	6	0	29	96	99	96	104	83	20
Joshua	0	7	0	29	76	101	68	98	71	23
Ben	0	4	0	23	94	98	96	101	79	25

Note. LSSF = Letter Sound Short Form raw scores; FSF = Dynamic Indicators of Basic Early Literacy Skills First-Sound Fluency raw scores; TOPEL = Test of Preschool Early Literacy standard scores; PK = print knowledge; PA = phonological awareness; CELF = Clinical Evaluation of Language Fundamentals–Preschool 2 Core Language standard scores.

were not required. This likely contributed to the improved results of Experiment 2. For most of the children, the progressive time delay strategy resulted in near errorless learning. Nevertheless, Matthew frequently responded incorrectly during the pause time. This may have contributed to his poor performance on the Alphabet Mastery Probe. His findings indicate that a predetermined time delay schedule may not be appropriate for all children.

The second modification to the study that seems to have contributed to the improved outcomes of Experiment 2 was the method in which letters were selected from a field of four. This may have contributed to children's discrimination among letters. The additional letters did not seem to be a distraction for children during the study. In fact, during the first-sound identification lesson, Edgar independently pointed to the letters that matched the words presented during the lessons. This indicates that the simultaneous instruction on phoneme awareness and letter sounds may be beneficial for teaching the alphabetic principle.

The third difference between experiments was that instruction for Experiment 2 was conducted one-on-one with children with researchers, rather than teachers, serving as the interventionists. This allowed for a fairly seamless transition between instruction and assessment, which seemed to benefit many of the children by improving generalization of skills. Of course, there are other benefits to one-on-one instruction, including fewer distractions and more opportunities to respond. Because the format was changed, it is impossible to tell whether the modifications to instruction or the change to individualized instruction was responsible for the improved results of Experiment 2. Nevertheless, the results of this study show promise for a novel method of combining PA and alphabet knowledge instruction in a supplemental curriculum for at-risk children.

Although small-group instruction for teaching reading skills does not seem to be less effective than one-on-one instruction (Foorman & Torgesen, 2001; National Early Literacy Panel, 2008), the effect of individualized instruction with increased opportunities to respond independently cannot be underestimated. Indeed, use of the one-on-one instructional format in Experiment 2 might be considered a Tier 3 intervention in an MTSS model. Nevertheless, the errorless learning resulting from the inclusion of a progressive time delay cannot be discounted as a major factor responsible for the learning of letter names and sounds. Because this study found instructive feedback to be an efficacious strategy for modeling letter names and sounds, future research may investigate variables such as the time delay and instructional format further.

General Discussion

The results of Experiment 2 are consistent with previous findings that instructive feedback is an efficient means for modeling behaviors for young children (Werts et al., 1995). Instructive feedback had been used previously to teach numeracy (Holcombe et al., 1993). Although the presentation of numerals and letters seems similar, the results of these studies cannot be directly compared as Holcombe and colleagues (1993) analyzed whether children required fewer lessons when skills had previously been modeled via instructive feedback. In the current study, children never received direct, explicit instruction on the alphabet skills. The responses evoked during the progressive time delay may have negated the necessity for later direct instruction. During the first three units of instruction, children were performing syllable-level awareness tasks but received instructive feedback targeting individual letter names and sounds, indicating that instructive feedback was efficacious for introducing more advanced skills. The current results support the findings of Werts and colleagues (2003) that skills modeled during instructive feedback are acquired at the same time as skills targeted during direct instruction.

Results of both experiments indicate that all children acquired the targeted PA skills, even when gains on letter names and sounds were not made. Furthermore, the instructive feedback added little time to the lessons. Teachers used instructive feedback with high fidelity following minimal training.

This study was the first to investigate the use of instructive feedback for teaching alphabet skills. The results indicate that it is a promising and efficient method for teaching early literacy skills. The multiple-baseline design across units of instruction allowed the opportunity to examine, in detail, the growth of early literacy skills throughout the curriculum. The replications across four units of instruction within each participant, along with the replications across nine individual participants, contribute confidence to the internal and external validity of the results. Rising baselines in a small percentage of the phases indicate that children acquired some letter names and corresponding sounds outside the intervention context. This is typical of children in preschool. A follow-up randomized control trial is necessary to determine the number of letters and sounds acquired specifically from the intervention as opposed to those acquired through typical maturation and general classroom instruction.

This study also used a novel method of examining children's development of discrete PA skills throughout the curriculum. The PA Fluency Probe provided detailed information about children's progress. Children's observed performance on the lessons aligned well with their performance on the subtests of the PA Fluency Probe, providing preliminary evidence of the utility of this measure for future studies or for monitoring progress of children in classrooms.

This study used a screening procedure across multiple sessions to identify candidates for a Tier 2 intervention. This was done to ensure children were not making gains as a result of classroom instruction prior to the intervention. All children had been enrolled in preschool for months prior to participating in the study. Thus, we considered the participants to be children who did not demonstrate adequate progress from Tier 1, whole-class instruction.

Instruction was provided to children in preschool classrooms by trained teachers, aides, and research personnel. Teachers expressed satisfaction with the intervention and the gains demonstrated by the children. In fact, teachers in all participating classrooms noted that they observed gains in children's abilities. This increases the social validity of the intervention, as teachers expressed a willingness to implement the PAth to Literacy intervention in the future.

Limitations

There are several ways in which this study could have been improved. First, there was inconsistency in the format of instruction between the two experiments. Experiment 1 used small groups, whereas Experiment 2 used one-on-one instruction. This makes it difficult to determine whether the gains demonstrated in Experiment 2 were due to the modifications in the presentation of instructive feedback or due to the change in format of instruction.

Second, research staff, rather than teachers, delivered the instruction in Experiment 2. Teachers in Experiment 1 delivered the lessons with a high degree of fidelity, even though providing feedback to the group may have been more difficult than for individuals. The interventionists for Experiment 2 easily incorporated the strategies and did so with a high degree of implementation fidelity. Future research needs to examine the feasibility of classroom teachers incorporating instructive feedback in their classroom instruction.

Third, children participated in a number of assessments throughout both experiments. Most children expressed frustration with testing. The preschoolers became bored and unfocused at times, likely because of the large amount of testing. The researchers attempted to disguise testing by using gamelike formats and reinforcers (i.e., stickers, marshmallows). Although this seemed to help, at times children's boredom resulted in decreased performance on assessments. At several points, children's performance on the assessments did not match their abilities during the lessons. This explains some of the variability in performance over time. Authentic assessment is a challenge inherent to the repeated testing required in single-subject design studies.

Clinical Implications

There are several clinical implications of this study. First, the results reinforce previous research that has found combining PA and alphabet instruction to be a particularly beneficial form of instruction. Educators and clinicians working with young children should consider teaching these skills simultaneously, as it may aid in the acquisition of the alphabetic principle. Previous research has found that children who are taught phoneme-level awareness and letter-sound correspondence, as in the current study, often acquire the alphabetic principle and show better performance on early literacy assessments (Byrne & Fielding-Barnsley, 1989).

Second, this study shows promise for the use of instructive feedback in early literacy interventions. This method of instruction is brief, easy to deliver, and appears to be beneficial, especially when children engage actively. Educators and clinical service providers may struggle to find quick and efficient methods of teaching school readiness skills. Instructive feedback seems to be an effective way to incorporate extra instruction within a variety of activities. This may be particularly suitable for reading interventionists and speech-language pathologists that frequently teach early literacy skills in small-group or one-on-one arrangements. For example, speech-language pathologists might include instructive feedback on letter names and sounds while working with individuals or small groups on a variety of linguistic or phonological tasks. The sample script in Appendix B might serve as a guide.

Third, this study indicates some overlap in PA skills. For example, children demonstrated gains on segmenting following instruction on blending. Nevertheless, children did not seem to generalize broader PA skills to the phoneme level without explicit instruction. Therefore, early literacy instruction should include explicit instruction on phoneme-level awareness.

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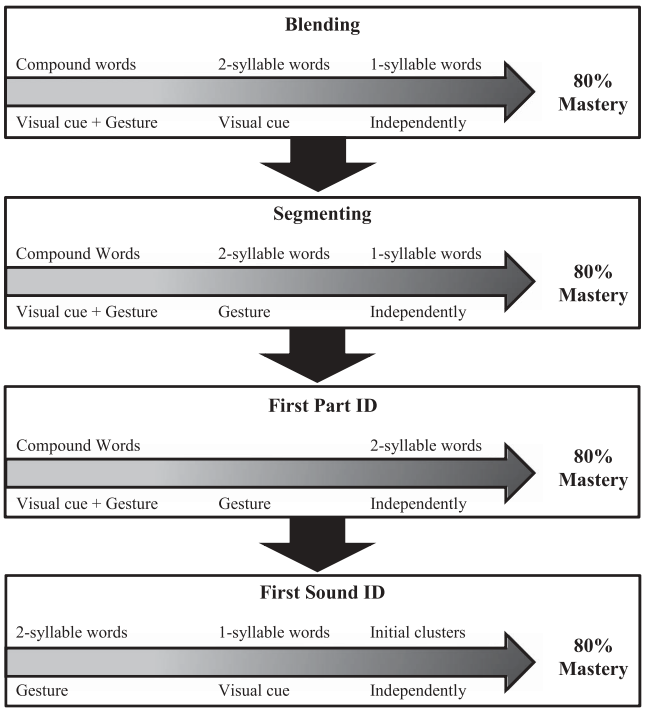
Appendix A

Scope and Sequence of Phonological Awareness Instruction

This figure highlights the word-level of instruction and type of supports children were provided within each phonological awareness unit of instruction in PAth to Literacy. Once children met 80% mastery, instruction progressed to the next phonological awareness unit.



The survey presented in this Appendix appears courtesy of the authors.

Appendix B

Sample PAth to Literacy Lesson[a]: Blending Two-Syllable Words

(Show page with treehouse, toolbox, jelly, and a bottle.) Bobby the Bear says: "Look: a treehouse!" *(Point to the treehouse.)* Let's say the parts of the word treehouse: tree (1) house. *(Stretch out a hand for each part).* Now let's say the word: treehouse. *(Clap).*

+	Yes! Treehouse! The letter T makes the /t/ sound.
–/NR	Let's try it again. Say the parts of the word treehouse with me: tree (1) house. *(Stretch.)* Now let's say the word: treehouse. *(Clap.)*

I am thinking about something I could use to build a treehouse. *(Point to the toolbox.)* Let's say the parts of the word toolbox: tool (1) box. *(Stretch out a hand for each part).* Now you say the word. (2)

+	Yes! Toolbox! The letter T makes the /t/ sound.
NR	Toolbox. Let's try it again. The parts of the word: tool (1) box. *(Stretch.)* Now you say the word. (2)
–	Toolbox. Let's try it again. The parts of the word: tool (1) box. *(Stretch.)* The word: toolbox. *(Clap.)* Again. The parts of the word: tool (1) box. *(Stretch.)* Now you say the word. (2)

I am thinking of something to eat. *(Point to the jelly.)* Let's say the parts of the word jel: (1) ee. *(Stretch out a hand for each part).* Now you say the word. (2)

+	Yes! Jelly! The letter J makes the /j/ sound.
NR	Jelly. Let's try it again. The parts of the word: jel (1) ee. *(Stretch.)* Now you say the word. (2)
–	Jelly. Let's try it again. The parts of the word: jel (1) ee. *(Stretch.)* The word: jelly. *(Clap.)* Again. The parts of the word: jel (1) ee. *(Stretch.)* Now you say the word. (2)

Let's try another word. *(Point to the bottle.)* Let's say the parts of the word bottle: bot (1) ull. *(Stretch out a hand for each part).* Now you say the word. (2)

+	Yes! Bottle! The letter B makes the /b/ sound.
NR	Bottle. Let's try it again. The parts of the word: bot (1) ull. *(Stretch.)* Now you say the word. (2)
–	Bottle. Let's try it again. The parts of the word: bot (1) ull. *(Stretch.)* The word: bottle. *(Clap.)* Again. The parts of the word: bot (1) ull. *(Stretch.)* Now you say the word. (2)

Note. + refers to feedback reinforcing correct responses and includes instructive feedback. NR refers to feedback provided if a child does not respond. – refers to feedback provided if a child responds incorrectly. Numbers in parentheses refer to pause time in seconds.

[a]Reproduced with permission of the publisher. Goldstein, H. (2016). *PAth to Literacy: A phonological awareness intervention for young children*. Baltimore, MD: Brookes.

Appendix C (p. 1 of 4)

Phonological Awareness Fluency Measure.

Blending Measure

Bobby Bear: "Hi! I'm Bobby Bear. I love blending. Do you know what blending is? Blending is when you put little parts of words together to make whole words. Will you help me blend little parts into whole words? Let's try one together! What word do these make: Can … Dee? They make the word … Candy! Now it's your turn to try some on your own. I'll say some little parts and you tell me the whole word! Ready? Let's go! What whole word do these make?" (begin items)

	Correct	Incorrect	DK/NR
mor - ning			
gr - een			
bed - room			
r - un			
tax - i			
sk - irt			
c - orn			
pen - cil			
p - op			
free - zer			
b - all			
l - eap			
mon - key			
black - bird			
s - un			
st - ew			
f - ork			
zipp - er			
bull - dog			
pl - ant			

Discontinue if a child scores 0 on the first 5 items.
If the student seems to have forgotten the task, prompt with "Remember to tell me what word these make."

Appendix C (p. 2 of 4)

Phonological Awareness Fluency Measure.

Segmenting Measure

Suki Squirrel: "Hi. I'm Suki Squirrel. I really like to segment words. Do you know what segmenting is? Segmenting is when you break whole words into little parts. Will you help me segment whole words into little parts? Let's do one together! What are the little parts of the word Rainbow? Hmm … The little parts of Rainbow are Rain … Bow! Now it's your turn to try some on your own. I'll say some whole words and you tell me the little parts! Are you ready? Let's segment words! What are the little parts of this word?" (begin items)

	Correct	Incorrect	DK/NR
doctor			
sofa			
little			
hot dog			
tiger			
chapter			
number			
purple			
pickle			
tunnel			
nighttime			
careful			
notebook			
muffin			
tablet			
never			
teapot			
farmer			
helmet			
raincoat			

Discontinue if a child scores 0 on the first 5 items.
If the student seems to have forgotten the task, prompt with "Remember to tell me the parts of the word."

Appendix C (p. 3 of 4)

Phonological Awareness Fluency Measure.

First Syllable ID Measure

Pablo Porcupine: "Hi. I'm Pablo Porcupine. My favorite thing to do is find the first part of words! That means I listen for the first little part I hear in the word! Please help me find the first parts in some whole words. Let's try one together! What is the first part of the word Racecar? The *first* part of racecar is Race! Now it's your turn to show me how you find the first parts of words. I'll say some whole words and you tell me just the first part of that word! Ok, let's go! What is the first part of this word?" (begin items)

	Correct	Incorrect	DK/NR
target			
shampoo			
tummy			
pony			
milkshake			
carrot			
seashell			
pigpen			
popcorn			
starfish			
snowman			
circle			
marker			
earring			
rooster			
starlight			
coffee			
magic			
bedtime			
bagel			

Discontinue if a child scores 0 on the first 5 items.
If the student seems to have forgotten the task, prompt with "Remember to tell me the first part of the word."

Appendix C (p. 4 of 4)

Phonological Awareness Fluency Measure.

Initial Sound ID Measure

Fae Fox: "Hi. I'm Fae Fox. I love finding the first sounds in words! Do you know how to find the first sound in a word? Listen to a whole word and then say the first sound you hear in that word! Can you help me find the first sounds in some whole words? Let's practice together! What is the first sound you hear in the word Cup? Hmm. … The first sound in the word Cup is /k/! Now it's your turn to find the first sounds in words. I'll say some whole words and you listen. Tell me the first sound you hear in each word! Let's get started! What's the first sound you hear in this word?" (begin items)

	Correct	Incorrect	DK/NR
forest			
sunshine			
handle			
zip			
window			
footstep			
skateboard			
fun			
driveway			
headlight			
climb			
dime			
hammer			
neighbor			
chair			
pumpkin			
coat			
sunny			
drink			
neck			

Discontinue if a child scores 0 on the first 5 items.
If the student seems to have forgotten the task, prompt with "Remember to tell me the first sound."
The surveys presented in this appendix appear courtesy of the authors.